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Research Article

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Prevalence, Distribution Mapping, and Risk Factor Analysis of Helminthiasis in Horses in Malang, Indonesia

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ABSTRACT

Background: Helminthiasis remains a widespread parasitic disease affecting horses globally, often reducing performance, body condition, and productivity. In tropical regions, environmental conditions favor parasite development, leading to persistent transmission. Despite its importance, epidemiological information on equine helminthiasis in many Indonesian regions remains limited.

Aims: This study aimed to determine the prevalence, spatial distribution, and environmental risk factors associated with gastrointestinal helminthiasis in horses in the Malang region, East Java, Indonesia.

Methods: A pilot epidemiological study was conducted to investigate gastrointestinal helminth infections and associated environmental risk factors in horses across Malang. Seventy fecal samples were collected from horses housed in randomly selected stables. Coprological examination was performed using standard diagnostic techniques, to detect helminth eggs. Spatial distribution of helminthiasis cases was mapped using QGIS software (version 3.28.12). Statistical analysis of potential risk factors was conducted using Chi-square tests ($P < 0.05$) in SPSS software (version 23), followed by calculation of Risk Ratio (RR) and Odds Ratio (OR) to evaluate the magnitude of associations.

Results: Helminthiasis was detected in 82.9% (58/70) of examined horses. The dominant parasite was *Strongylus* sp. (78.6%; 55/70), followed by mixed infections with *Strongylus* sp. and *Parascaris equorum* (2.9%; 2/70), and *Strongyloides westeri* (1.4%; 1/70). Spatial analysis showed widespread distribution across 22 stable locations. Proximity of stables to rivers was significantly associated with infection risk ($P < 0.05$), whereas altitude showed no significant association ($P > 0.05$).

Conclusion: Gastrointestinal helminthiasis is highly prevalent among horses in the Malang region and widely distributed across stables. These findings highlight the importance of routine parasitological monitoring and integrated parasite control strategies to reduce infection risk and improve equine health management.

INTRODUCTION

Helminthiasis remains a major health concern in horses worldwide, with significant impacts on animal performance, body condition, and productivity (Molento et al., 2024). Gastrointestinal helminths infect the digestive tract of horses and may cause chronic health disturbances that compromise nutrient absorption, immune responses, and overall physiological condition. Although these infections are rarely fatal, they can lead to weight loss, poor body condition, decreased work performance, anemia, and increased susceptibility to secondary diseases. Consequently, helminthiasis represents an important constraint in equine management, affecting both animal welfare and economic productivity in horse-related activities (Mathewos et al. 2021). The prevalence of gastrointestinal helminths in horses has been widely reported across different regions of the world. In Europe, infection rates range from 30–40% despite the implementation of structured deworming programs and improved veterinary management practices (Relf et al., 2013). In the United States, the prevalence can reach up to 70%, depending on management systems, pasture hygiene, and the frequency of anthelmintic treatment (Nielsen et al., 2010). These findings indicate that helminth infections remain persistent even in areas with well-established parasite control strategies.

In tropical countries such as Indonesia, the prevalence of helminthiasis tends to be higher. Previous studies have reported infection rates exceeding 70% in horse populations (Sinaga & Tanjung, 2022). This high prevalence is strongly associated with tropical environmental conditions, including high temperature and humidity, which favor the survival and development of infective parasite larvae in pasture environments. In addition, inadequate farm sanitation, poor manure management, and the absence of integrated parasite control programs contribute to the continued transmission of helminths (Ekawasti et al., 2021). Several helminth species are of particular concern in horses due to their pathogenic potential. Species belonging to the genus *Strongylus* are among the most important gastrointestinal parasites and have also been reported to possess zoonotic potential (Sinaga and Tanjung, 2022). These parasites can cause intestinal damage and vascular complications that negatively affect horse health. Another important parasite is strongyle type-*Trichostrongylus axei*, which infects the stomach of horses and may induce gastritis, colic, and, in severe cases, fatal outcomes (Shatyaayyupranathasari et al., 2021).

In Indonesia, regional prevalence varies considerably. Infection rates have been reported at 73.3% in Central Java, 87% in Sumbawa, and 76% in East Lombok (Chaerunissa et al., 2019). Host-related factors such as age and nutritional status influence susceptibility to infection by affecting immune competence, while environmental determinants, may also contribute to transmission dynamics (Tesfu et al., 2014). The scientific data regarding the prevalence and spatial distribution of helminthiasis in horses in Malang area remain limited. Therefore, this study aims to determine the prevalence, spatial distribution, and environmental risk factors associated with helminthiasis in horses in this area.

MATERIALS AND METHODS

Ethical Approval

The research protocol received approval from the Animal Care and Use Committee of Universitas Brawijaya (Ref. No. 120-KEP-UB-2024). All procedures were performed in accordance with institutional and national ethical guidelines for animal research. Permission from horse owners was obtained prior to sampling, and all sampling activities were carried out in compliance with local regulations and established animal welfare standards.

Animals and Research Design

The study conducted in Malang Raya involved a preliminary design to estimate helminthiasis prevalence and identify risk factors, providing essential baseline data for further research. A total of 70 fecal samples were randomly collected from various stables and examined using standard coprological methods, which remain the cornerstone of equine parasitology diagnosis despite some limitations in detecting prepatent infections (Andersen et al., 2013).

Sample Collection

Fecal samples for parasite detection are collected directly from the rectum using sterile gloves to minimize contamination, ensuring sample integrity for accurate diagnosis. After collection, samples are placed in labeled containers, stored in cool conditions, and promptly transported to Laboratory of Veterinary Parasitology, specialized laboratories for analysis to preserve parasite viability and prevent degradation (Meurs et al., 2017).

Microscopic Examination of Feces

Flotation techniques are widely used to identify nematode and cestode eggs due to their ability to separate parasite eggs based on specific gravity differences, while sedimentation is preferred for detecting heavier trematode eggs. Coprological techniques such as sedimentation and flotation are commonly used for detecting helminth eggs in horse faeces. A modified flotation method using 2 g of feces in 18 mL sucrose solution has been shown to improve egg recovery and detection sensitivity (Boelow et al., 2022). Preparations were examined under a light microscope (Olympus CX-23®, Japan), and parasite identification was based on egg morphology.

Data and Statistical Analysis

Prevalence of helminthiasis is often calculated from qualitative test results, with statistical associations between infection and environmental factors such as altitude and distance to river/water bodies analyzed using Chi-square tests and logistic regression models. Studies have applied Odds Ratios (OR) and Risk Ratios (RR) to quantify the strength of these associations, setting statistical significance at $P < 0.05$ to identify meaningful risk factors (Sedo et al., 2025).

Geographical Information System (GIS) Mapping

Positive case data were processed with QGIS to map the spatial distribution of helminthiasis in Malang Raya. Spatial data (shapefiles) were obtained from the Geospatial Information Agency (2022), while non-spatial data such as coordinates and population were recorded in CSV format. These datasets were integrated to produce distribution maps according to QGIS guidelines (QGIS Development Team, 2019; Schluth et al., 2023).

Study Limitation

Limitation of this study is that parasite infection was assessed only qualitatively based on egg presence or absence. Quantitative measurements such as fecal egg count (EPG) using the McMaster technique were not performed; therefore, the intensity of infection could not be evaluated. Host-related variables such as age, sex, nutritional status, feeding practices, and water source were not recorded in this study, which may limit the interpretation of host susceptibility factors.

RESULTS AND DISCUSSION

The microscopic examination of fecal samples collected from 70 horses in Malang revealed a high prevalence of gastrointestinal helminth infections. Of the total samples analyzed using flotation, and sedimentation techniques, 58 samples (82.9%) were confirmed positive for helminthiasis. This prevalence indicates a widespread presence of parasites within the examined equine population, as infection levels exceeding 50% are generally categorized as high in epidemiological studies of parasitic diseases. Among the positive samples, the dominant parasite species identified was *Strongylus* sp., accounting for 78.6% of infections (55/70). Mixed infections involving *Strongylus* sp. and *Parascaris equorum* were detected in 2.9% of samples (2/70), while *Strongyloides westeri* infection was identified in 1.4% of cases (1/70) (Table 1).

Morphological identification of parasite eggs was performed using standard parasitological criteria based on microscopic examination. Eggs of *Strongylus* sp. were the most frequently detected and were characterized by an elliptical or oval shape, thin transparent walls, and internal blastomeres arranged in clusters resembling grape-like structures (Figure 1). Morphological identification of *Strongylus* sp. eggs is typically based on these diagnostic features, with egg sizes generally ranging from approximately 80–100 µm in length. These characteristics are consistent with recent descriptions confirming that strongyle eggs are morphologically distinct and can be identified microscopically in equine fecal samples (Puput et al., 2023). The predominance of *Strongylus* sp. in this study indicates that strongyle infections remain the major gastrointestinal parasitic problem affecting horses in the study area. The global importance of strongyle infections in horses has been widely recognized, as these parasites are associated with intestinal damage, larval migration, and clinical manifestations such as colic, emphasizing the importance of accurate morphological identification for diagnosis and control (Tzelos et al., 2017).

The second parasite species detected was *Parascaris equorum*, which occurred in 2.9% of the examined samples. The eggs observed were round, yellowish in color, and surrounded by thick outer walls containing

Table 1. Prevalence of Helminthiasis by Species in Horses in Malang

Species	Positive	Prevalence
Strongylus sp	55	78.6%
*Strongylus sp & Parascaris equorum**	2	2.9%
Strongyloides westeri	1	1.4%
Total	58	82.9%

blastomeres (Figure 2). These characteristics correspond with standard parasitological descriptions indicating that *Parascaris equorum* eggs are round, yellowish-brown, and covered by thick, rough outer shells containing blastomeres or a single cell (Mbafor, 2021; Lyons and Tolliver, 2014). Although the prevalence observed in this study was relatively low, *P. equorum* remains an important parasite because it primarily affects young horses and foals. Previous investigations have reported that the prevalence of *P. equorum* varies considerably across different geographic regions, ranging from approximately 8% to more than 50%, depending on management systems, environmental conditions, and deworming practices (Mbafor, 2021; Lyons and Tolliver, 2014).

In addition, *Strongyloides westeri* infection was detected in 1.4% of the samples. Eggs of this parasite are morphologically similar to those of *Strongylus* sp., but they are smaller and contain a coiled larval structure within the egg (Figure 3). According to Lyons and Tolliver (2014), *Strongyloides westeri* eggs measure approximately 40–52 × 32–40 µm, which is about half the size of strongyle eggs, and they contain a larval stage within the egg. Although detected at a relatively

Figure 1. 400x magnification observation of *Strongylus sp.* eggs.

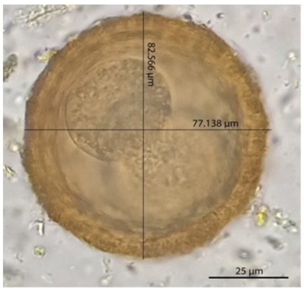

Figure 2. 400x magnification image of *Parascaris equorum* eggs.

Figure 3. *Strongyloides westeri* eggs, collected from the float test and examined at 400x magnification.

low frequency in this study, the presence of *S. westeri* indicates that multiple helminth species circulate within the equine population in Malang. Field studies have documented co-infections of *P. equorum* and *S. westeri*, particularly in foals, with prevalence influenced by factors such as host age, treatment history, and seasonal variation (Lyons and Tolliver, 2014). The presence of multiple helminth species within horse populations highlights the need for integrated parasite control strategies that consider local epidemiological conditions (Emeto et al., 2022).

Spatial distribution analysis demonstrated that helminthiasis cases were unevenly distributed across sub-districts in the Malang region (Figure 4). The highest prevalence was recorded in Wagir (100%), followed by Batu (93.3%) and Lowokwaru (91.6%), while Turen showed no positive cases. Mapping of the 58 positive samples across 22 sampling locations revealed that *Strongylus* sp. was the most widely distributed parasite species. Clusters of infection were particularly concentrated in Batu and Lowokwaru, whereas infections caused by *P. equorum* and *S. westeri* were sporadic and limited to isolated locations. Such spatial heterogeneity may reflect differences in environmental conditions, pasture management practices, sanitation levels, and horse density among farms. Epidemiological studies consistently demonstrate that parasite transmission is strongly influenced by local ecological conditions and livestock management systems. Changes in abiotic and biotic factors, including habitat structure, biodiversity, host population density, and human interventions, can interact in complex ways to influence parasite transmission dynamics (Cable et al., 2017). Environmental disturbances such as deforestation, land-use changes, water management projects, and pollution may alter ecological habitats and host–parasite interactions, thereby modifying the spatial distribution and intensity of parasitic diseases. Agricultural practices and sanitation infrastructure also play important roles in shaping transmission intensity by influencing host exposure and parasite survival in the environment (Gonzalez-Ramirez et al., 2022). Consequently, integrated ecological approaches that consider interactions among environmental factors, soil organisms, and parasite life cycles are essential for understanding and managing parasite transmission in livestock systems (Boughton et al., 2024).

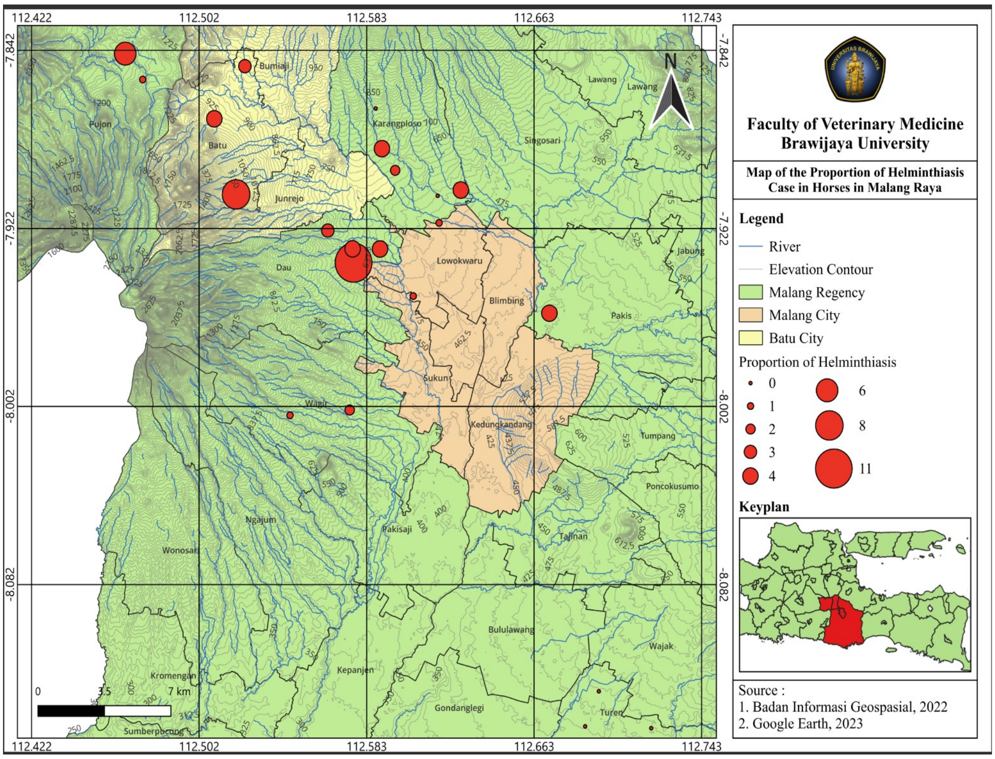

Figure 4. Spatial distribution of helminthiasis-positive horses across sampling locations in Malang Raya.

Risk factor analysis using Chi-square tests, Odds Ratio (OR), and Risk Ratio (RR) calculations was performed to evaluate the association between environmental variables and helminthiasis occurrence. The results showed that the elevation of stable locations (>700 meters above sea level versus <700 meters above sea level) did not have a statistically significant relationship with helminth infection prevalence ($P > 0.05$; p value = 0.0939). The calculated OR value of 0.95 (95% CI) and RR value of 1.034 (95% CI) further indicated that altitude had minimal influence on the occurrence of helminthiasis in the study area. These findings suggest that parasite transmission in the Malang region is not primarily determined by elevation differences but may instead be influenced by other ecological and management-related factors.

In contrast, the distance between stables and river sources showed a statistically significant association with helminth infection ($P < 0.05$; p value = 0.034). The OR analysis indicated that horses raised in stables located near rivers had a 4.400 times higher risk of infection compared with those located further away. Similarly, RR analysis revealed that stables located less than 350 meters from rivers had a 1.347 times greater likelihood of helminth infection compared with those located more than 350 meters away (Table 2). The significant association between helminth infection and proximity to rivers may be related to the ecological characteristics of riparian environments. Riparian zones generally maintain higher moisture levels, denser vegetation, and more stable microclimatic conditions than adjacent upland areas. Such conditions can enhance the environmental persistence of helminth eggs and infective larvae, thereby increasing opportunities for host exposure.

The use of a 350-meter threshold in the present study was intended to distinguish stables potentially influenced by riparian environmental conditions from those located outside the immediate riverine landscape (Graziano et al., 2022). It should be noted that the 350-meter threshold was used as an operational spatial classification rather than a biologically defined transmission distance for equine helminths. Further studies incorporating detailed environmental measurements, grazing patterns, and hydrological variables are needed to determine the most relevant spatial scale for parasite transmission in horse populations.

These findings highlight the important role of environmental moisture in parasite transmission. Moist environments near rivers create favorable conditions for the survival and development of infective helminth larvae in pasture soils, thereby increasing the risk of exposure for grazing horses. Previous studies have shown that strongyle larvae are capable of migrating up to approximately 150 cm from fecal pats and may survive overwinter in suitable environmental conditions. Larval stages have been detected up to 17-18 months after fecal deposition, indicating the strong influence of environmental temperature and moisture on larval persistence (Osterman-Lind et al., 2022). Soil characteristics also influence larval survival; for example, peat soils support greater survivability of strongyle larvae compared with sandy or clay soils due to their higher moisture retention capacity (Malek et al., 2025). Additionally, vegetation cover and soil

Table 2. Distribution of helminth infection according to environmental risk factors

Variable	Category	Positive (n)	Negative (n)	Total (n)	OR	RR	p-value
Altitude	>700 m	20	4	24	0.950	1.034	0.0939
	<700 m	38	8	46		0.983	
Distance of stable to river	<350 m	44	5	49	4.400	1.347	0.034
	>350 m	14	7	21		0.722	

moisture protect eggs and larvae from desiccation and sunlight, facilitating their development and transmission in grazing environments (Maharramov, 2024).

The significant association between helminth infection and proximity to rivers may also be explained by local horse management practices observed during field sampling. Most horses included in this study were maintained under semi-intensive systems, where forage was collected from surrounding areas, including grasslands located near riverbanks. These humid environments may serve as favorable habitats for the development and survival of infective helminth eggs and larvae. Moisture is a critical factor influencing larval viability, allowing infective stages to persist longer on vegetation and soil surfaces. Consequently, horses consuming forage harvested from these areas may have an increased likelihood of ingesting infective larvae.

Overall, the high prevalence of helminthiasis observed in this study confirms that gastrointestinal parasites remain a major health concern for horses in Malang. The infection rate of 82.9% is comparable with reports from other endemic regions in Africa and Asia where prevalence often exceeds 70%. In contrast, lower prevalence levels are typically observed in Europe and North America due to improved parasite control programs and better stable management practices. Traditional parasite control strategies based on frequent blanket deworming are increasingly being reconsidered because of the growing problem of anthelmintic resistance. Consequently, there has been a shift toward more sustainable and evidence-based parasite control strategies, including selective treatment based on fecal egg count monitoring (Nielsen, 2012).

Recent research continues to highlight the importance of strongyle infections as major causes of intestinal pathology and colic in horses due to larval migration through blood vessels and tissues. These findings emphasize the need for improved parasite control strategies that combine regular fecal egg count monitoring, strategic anthelmintic use, and improved sanitation in stables and pastures to reduce environmental contamination and transmission (Ryu et al., 2025). Integrated parasite management approaches, such as rotational grazing, targeted selective deworming based on fecal egg counts, and reduced reliance on routine blanket treatments, have been shown to effectively reduce infection pressure and delay the development of anthelmintic resistance. For example, combining rotational grazing with feeding pellets containing parasiticidal fungi has been shown to significantly decrease strongyle egg counts over a one-year period (Hernandez et al., 2018). Additionally, selective therapy guided by fecal egg count monitoring is increasingly recognized as a sustainable parasite control approach, although careful surveillance remains necessary because susceptibility to treatment may vary among strongyle species (Hamad et al., 2024). Implementing these integrated control strategies in regions such as Malang could substantially improve equine health, productivity, and welfare by reducing parasite burdens while slowing the emergence of anthelmintic resistance.

CONCLUSION

The study revealed a high prevalence of gastrointestinal helminthiasis (82.9%) in horses in Malang, dominated by *Strongylus* sp. Environmental factors, particularly proximity to rivers, significantly increased infection risk, while elevation had no effect. These findings highlight the need for improved parasite monitoring and integrated control strategies to reduce helminth transmission in the region.

AUTHORS CONTRIBUTION

RY: Conceptualization; Methodology; Validation; Formal analysis; Writing-Original draft; Writing-Review & Editing; Supervision; Project administration and Funding acquisition. NAM: Methodology; Software; Validation; Investigation; Data Curation; Writing- Original draft. SKR: Methodology; Writing-Review & Editing.

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"The authors declare that they have no conflicts of interest".

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